

2005 Climate Change Conference

Compliments of  **King County**

Will the Well go Dry?

Potential impacts of climate change
on groundwater systems used by
municipal water suppliers

Chris Pitre

Qwest Field, October 27, 2005



Climate Change

- ◆ Global warming is real.
- ◆ Climate change will happen.
- ◆ Surface water effects are well studied
- ◆ How will it affect groundwater resources?



Conclusions

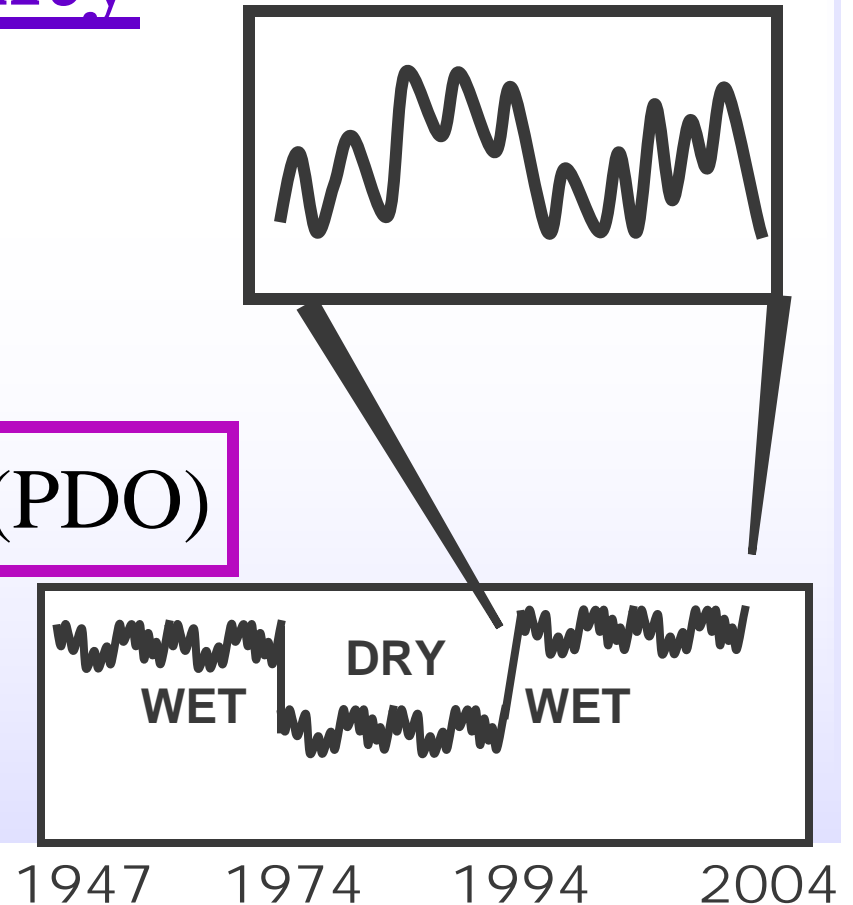
- ◆ Is groundwater supply dependable ? – **NO**.
- ◆ It is sensitive to climatic variability.
- ◆ Historical data proves it.
- ◆ **Global warming will affect groundwater supply.**

Climatic Variability

- ◆ El Niño/La Niña
= 2-3 year cycle

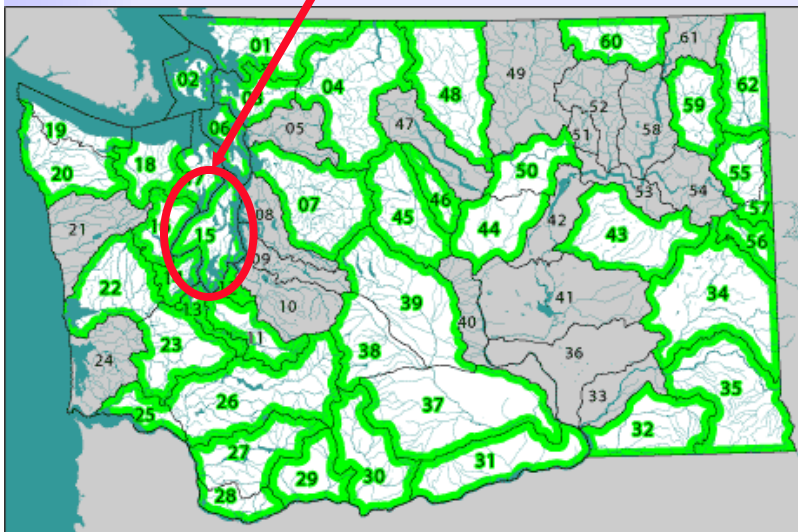
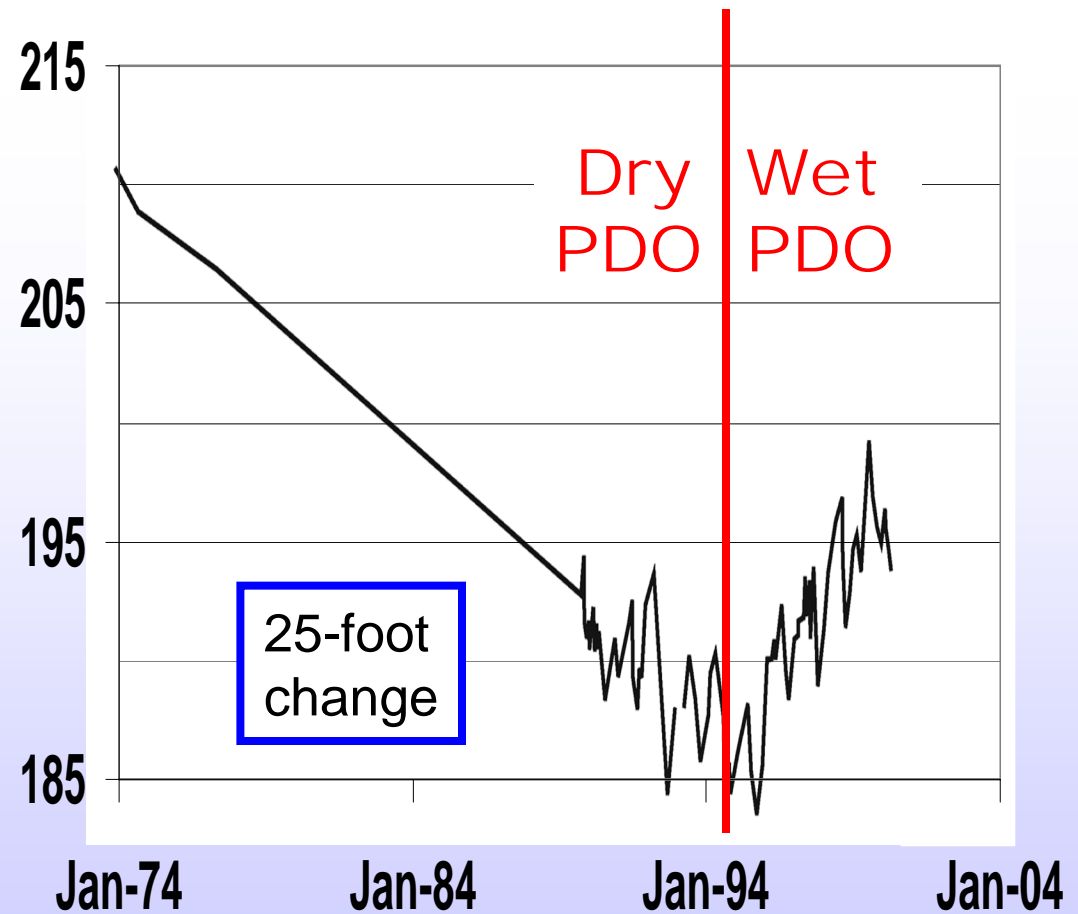
- ◆ Pacific Decadal Oscillation (PDO)
= 20-30 year cycle

- ◆ Global Warming
= **OUR FUTURE**



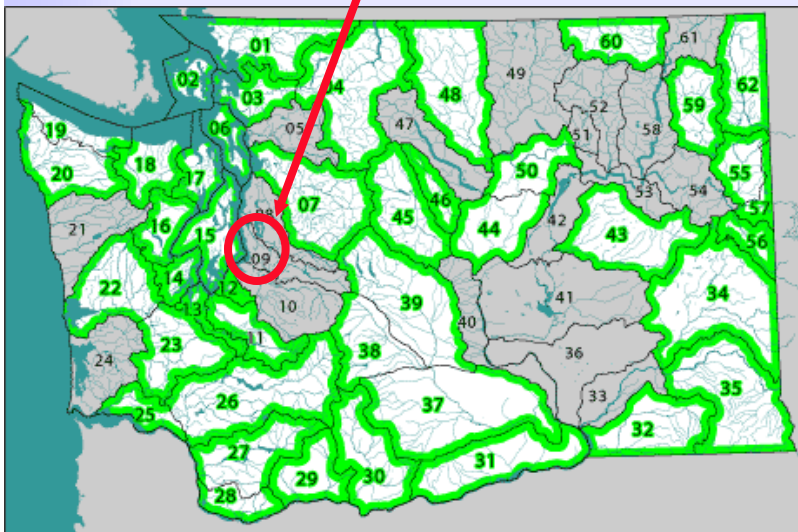
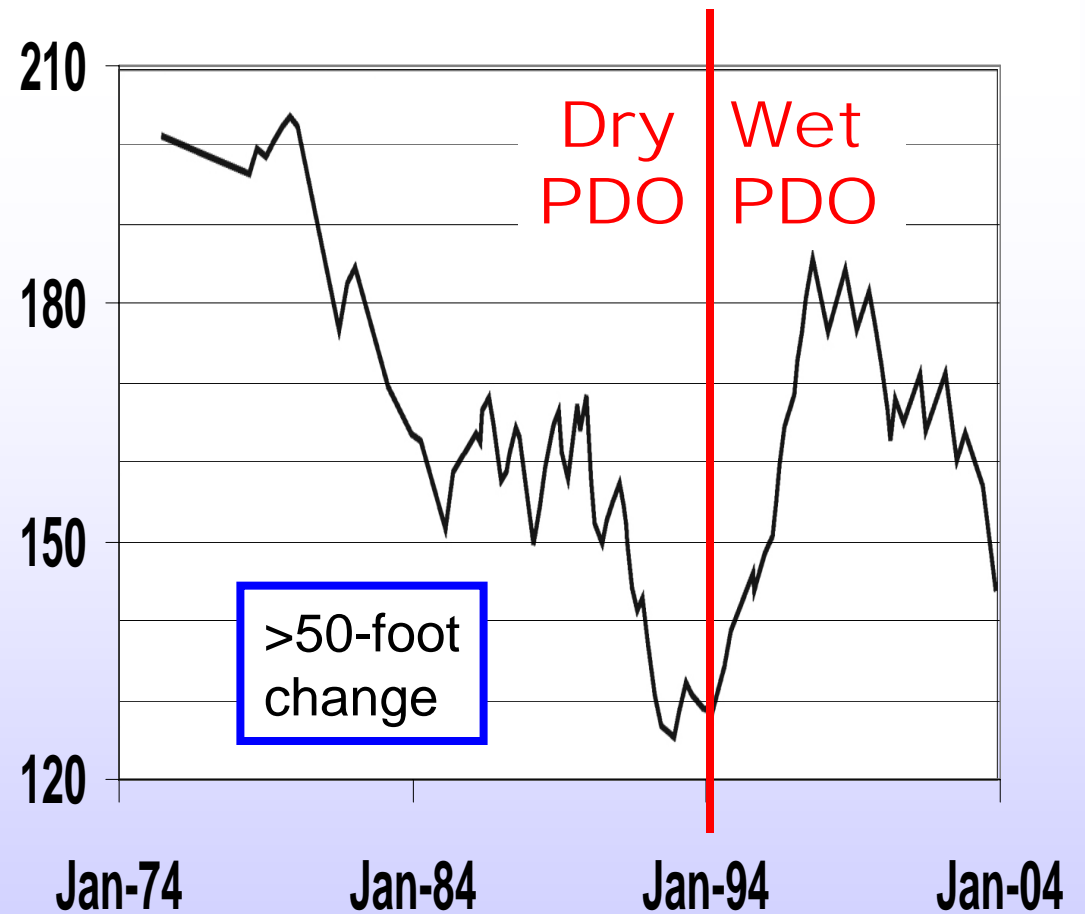
Historical Water Levels

Kitsap County (Island Lake)



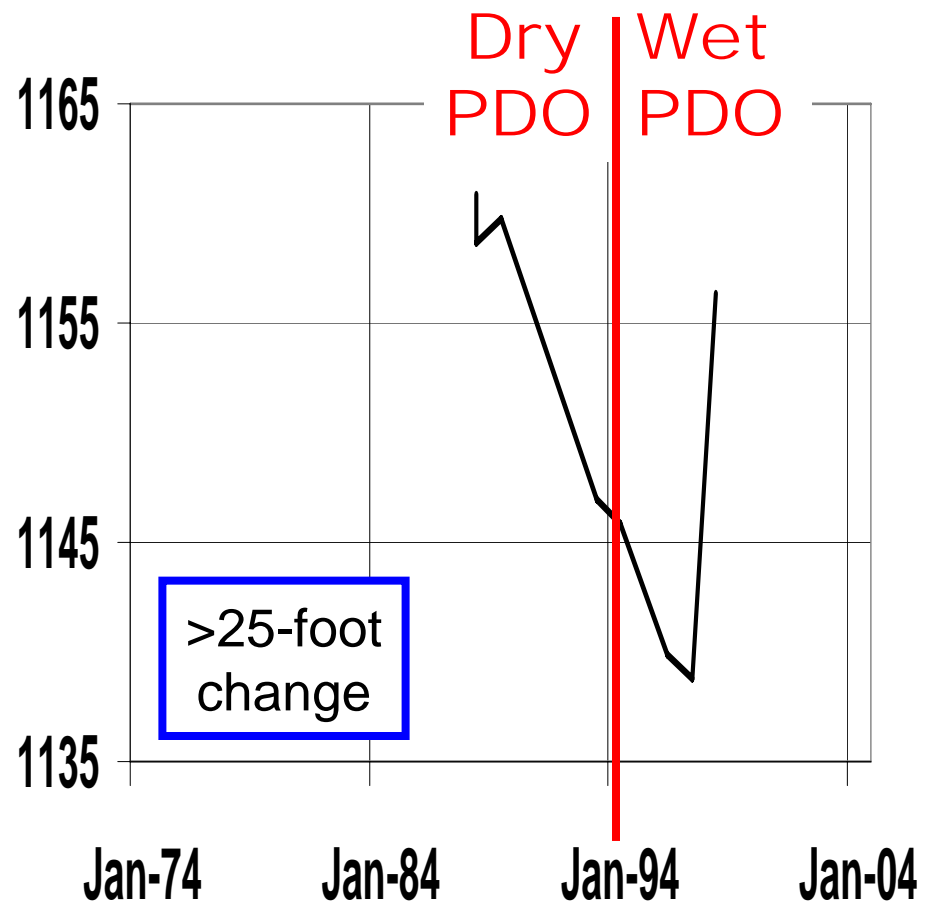
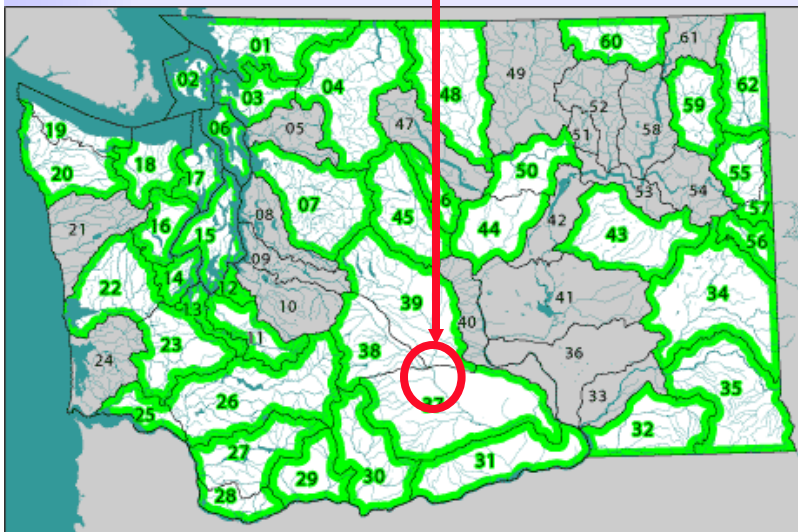
Historical Water Levels

Pierce County (Lakehaven)



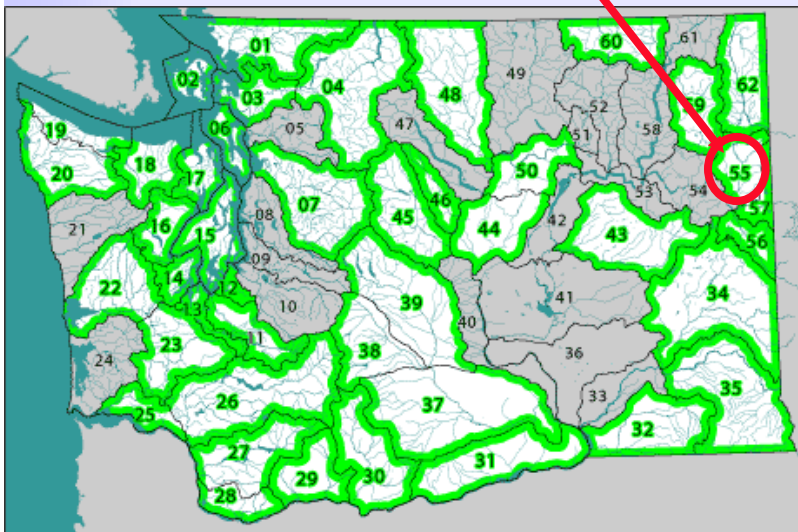
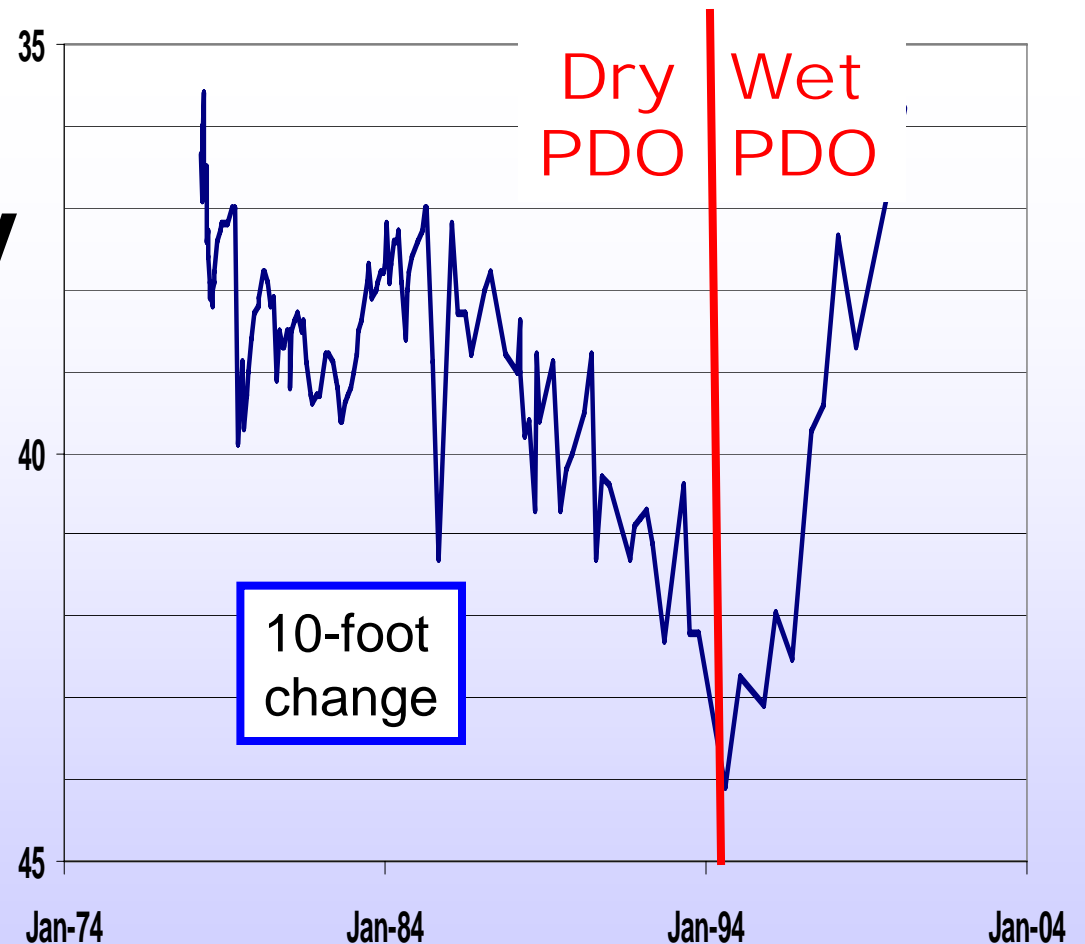
Historical Water Levels

Yakima County



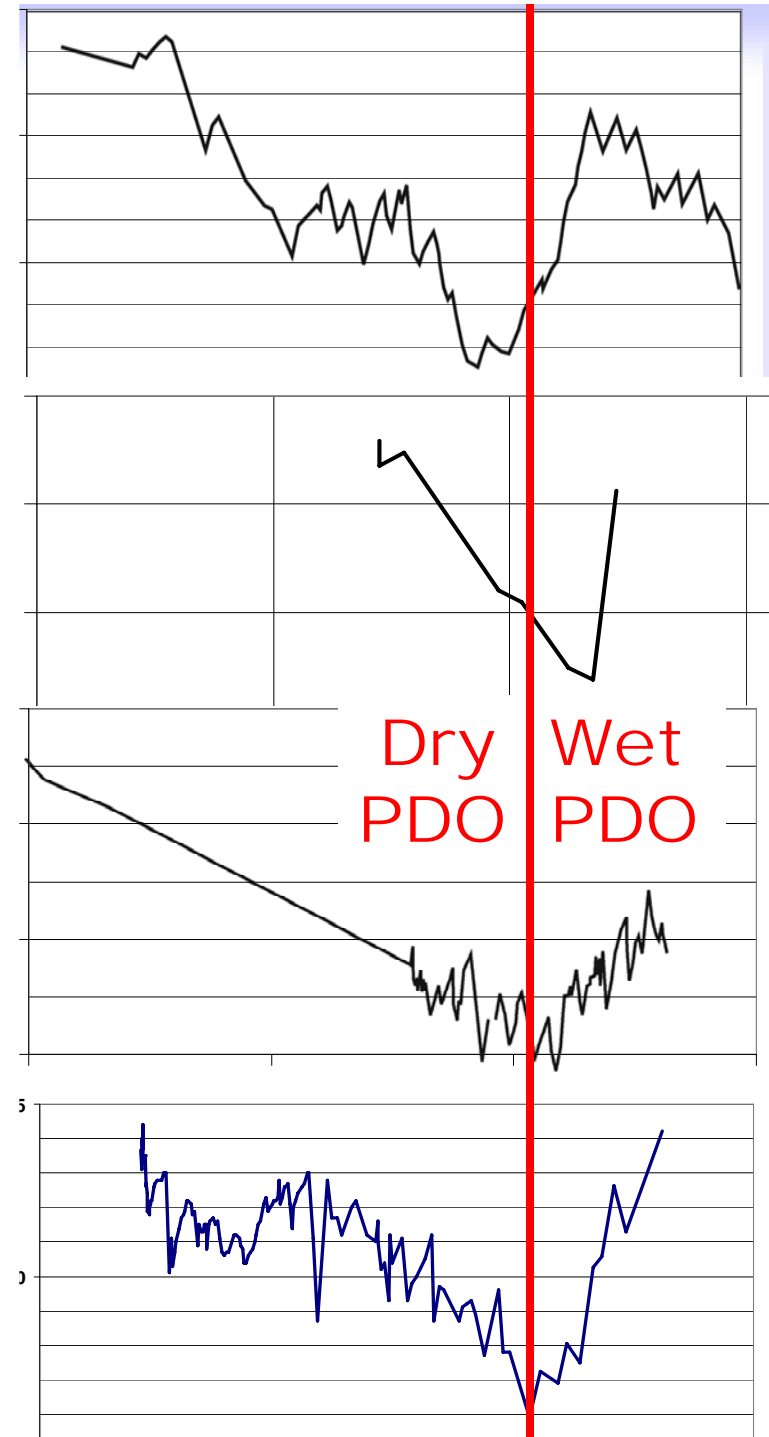
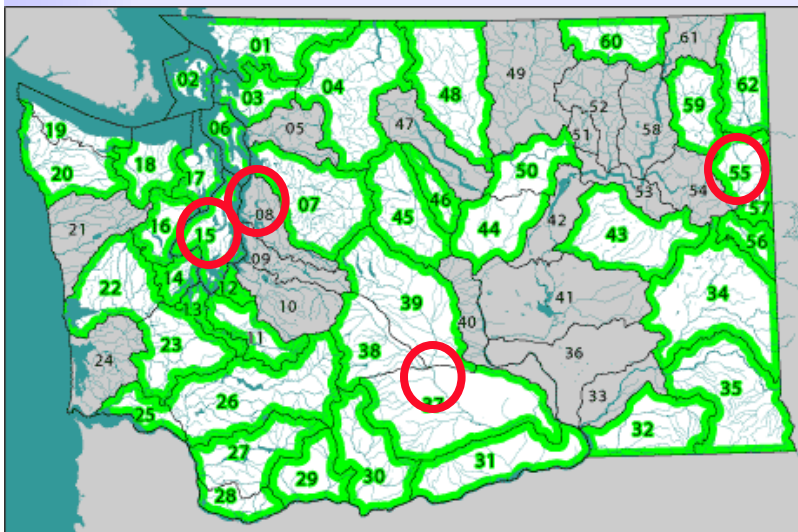
Historical Water Levels

Spokane County (Chattaroy)



Water Levels Respond Regionally to Climate Variability

If PDO is impressive –
what will global warming
do?



Predicted Changes in the Pacific Northwest

(Climate Impacts Group, University of Washington, May 2004)

	Temperature	Precipitation	
	(°F)	Oct-Mar	Apr-Sept
2020's	+2.5	+8%	+4%
2040's	+3.8	+9%	+2%

Wetter and Hotter
=
More, or Less Water Availability?



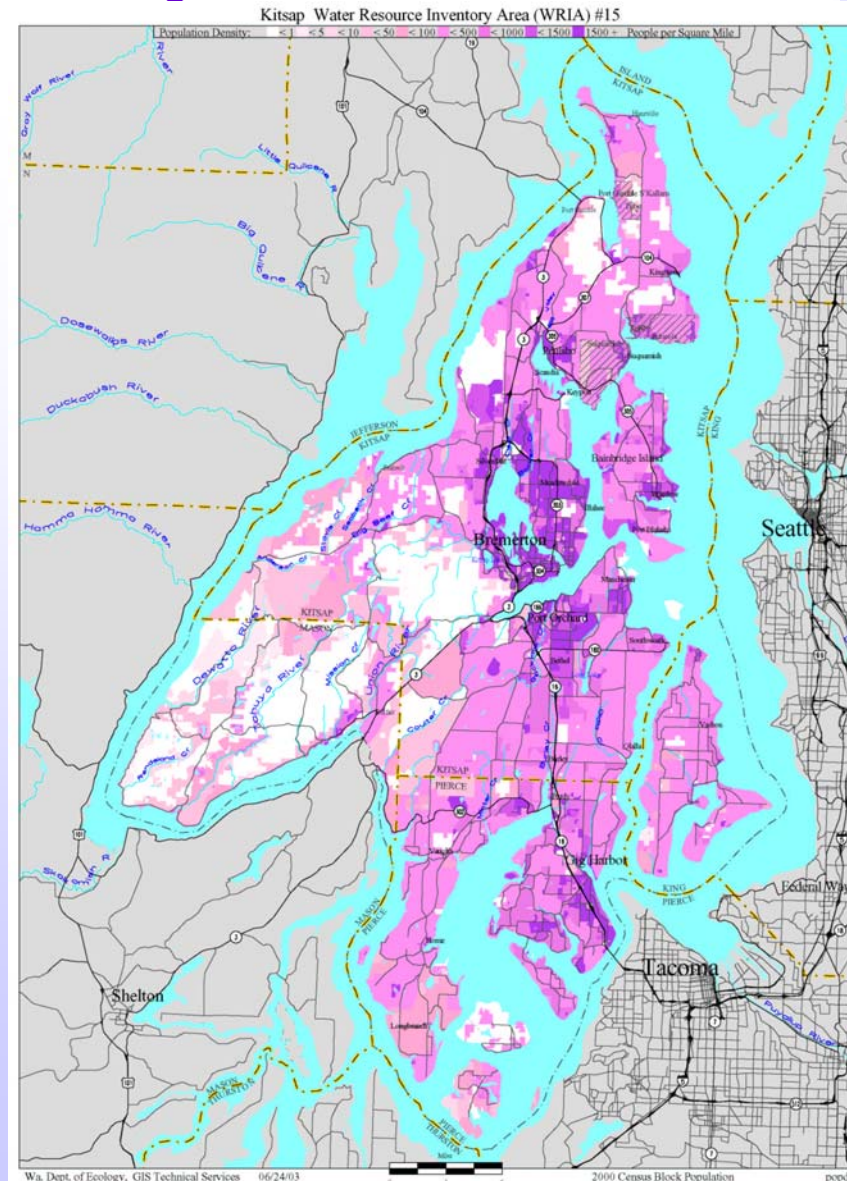
Case Study 1: Kitsap Peninsula

◆ Puget Lowland

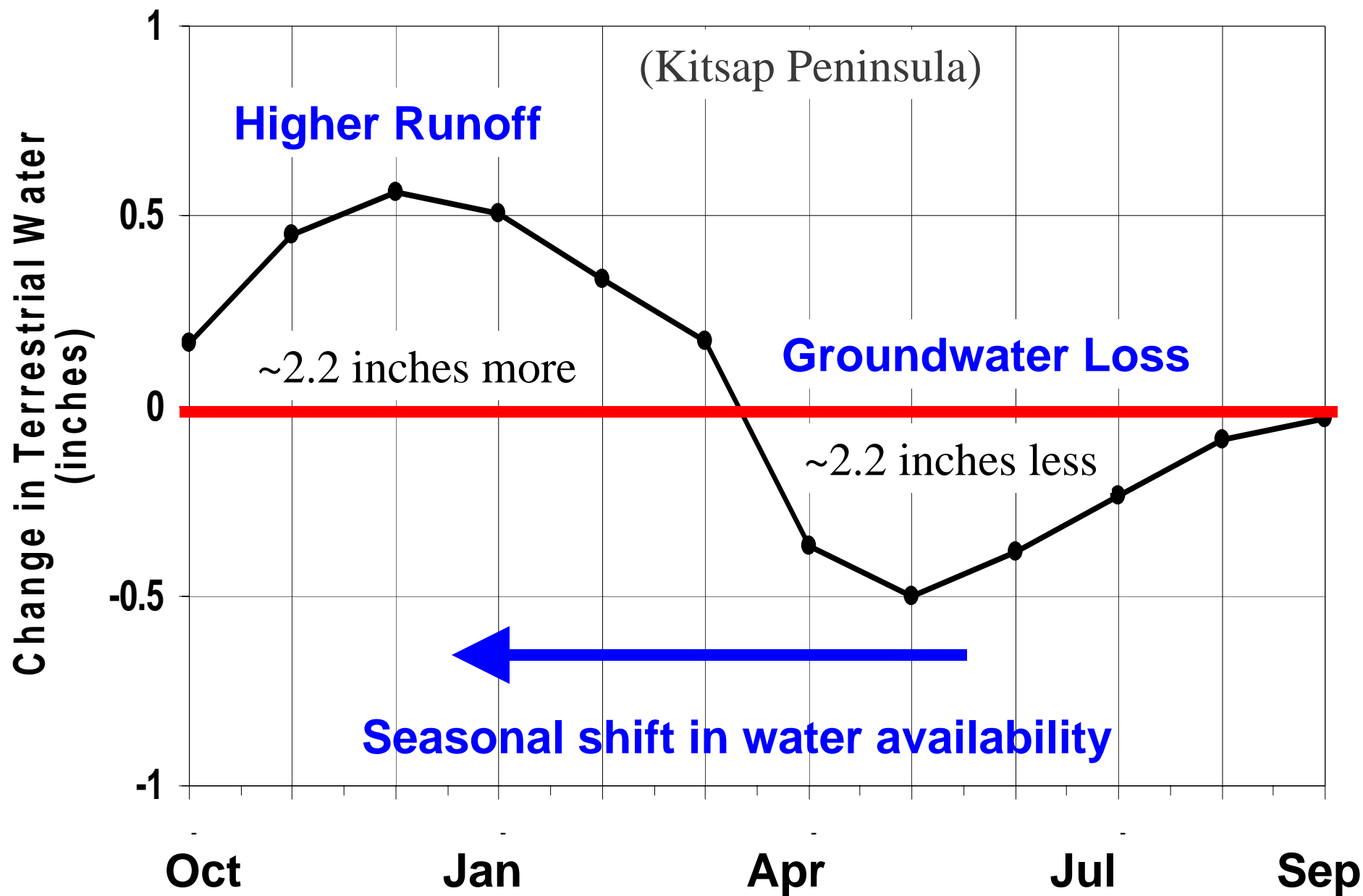
NO SNOW PACK

- Self contained watershed
- Urbanizing watershed
- Groundwater supply dependent

◆ Spreadsheet approach to predict climate change effects



Change in Water Availability (2040)



Implications

- ◆ **Higher:**
 - Stormwater runoff
 - Winter stream flows
- ◆ **Lower:**
 - Groundwater recharge
 - Summer stream flows
- ◆ **Longer, drier summers**
- ◆ **Greater summer peaking demand**

Solutions

- **Stormwater management**
- **Enhance groundwater recharge**
- **Reclaimed water**
- **Conservation**



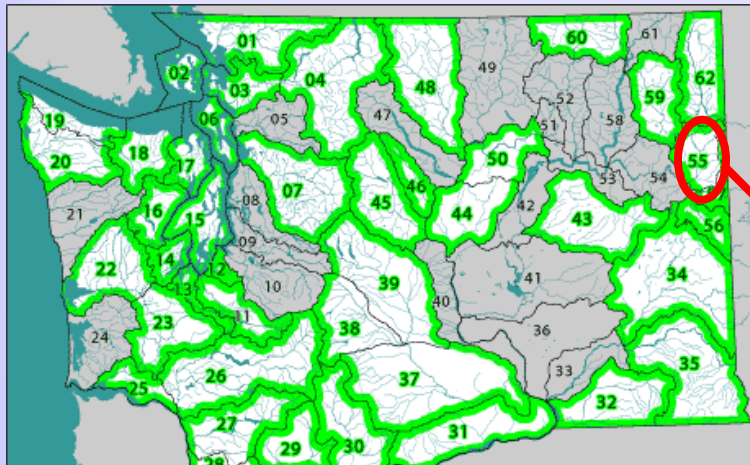
Case Study 2: Little Spokane River

◆ Eastern Washington

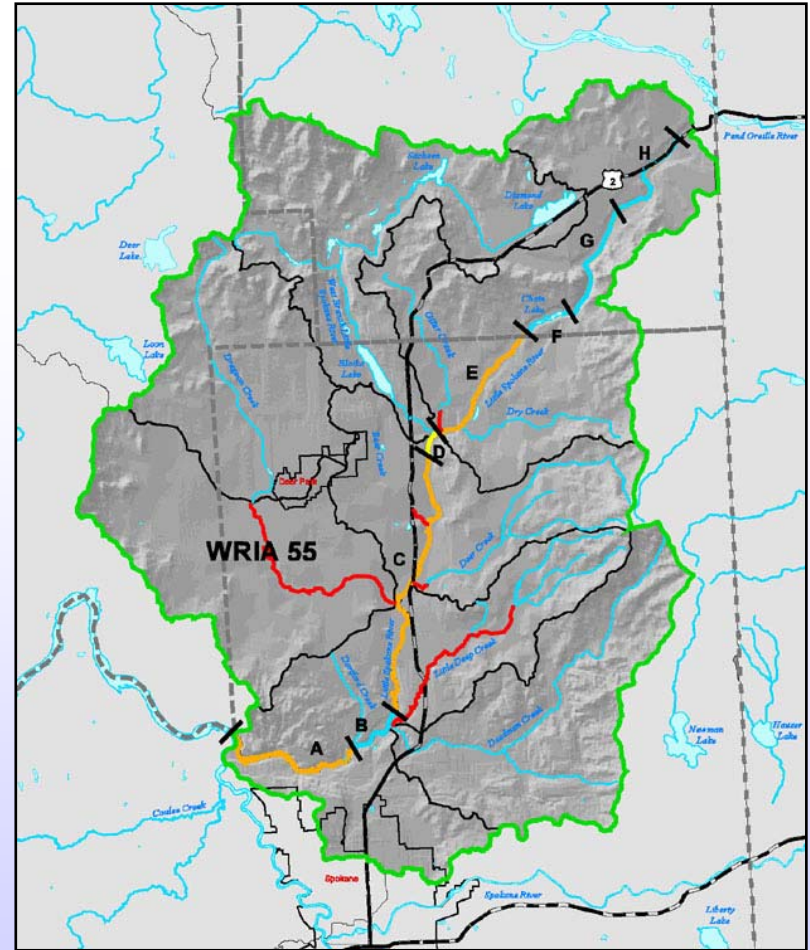
RAIN AND SNOW MIX

- Self contained watershed
- Urbanizing watershed
- Groundwater supply dependent

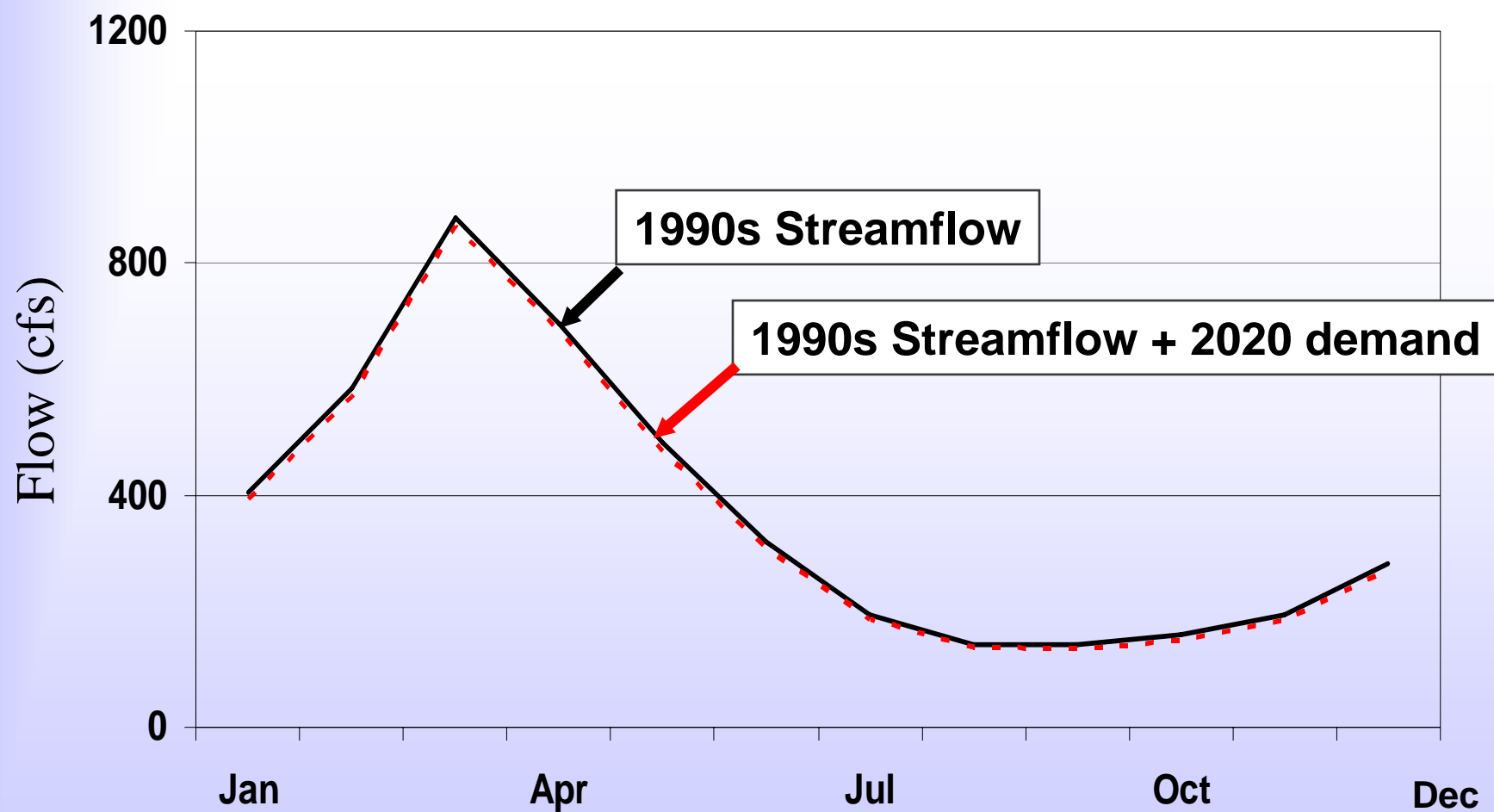
◆ Integrated model approach to predict climate change effects



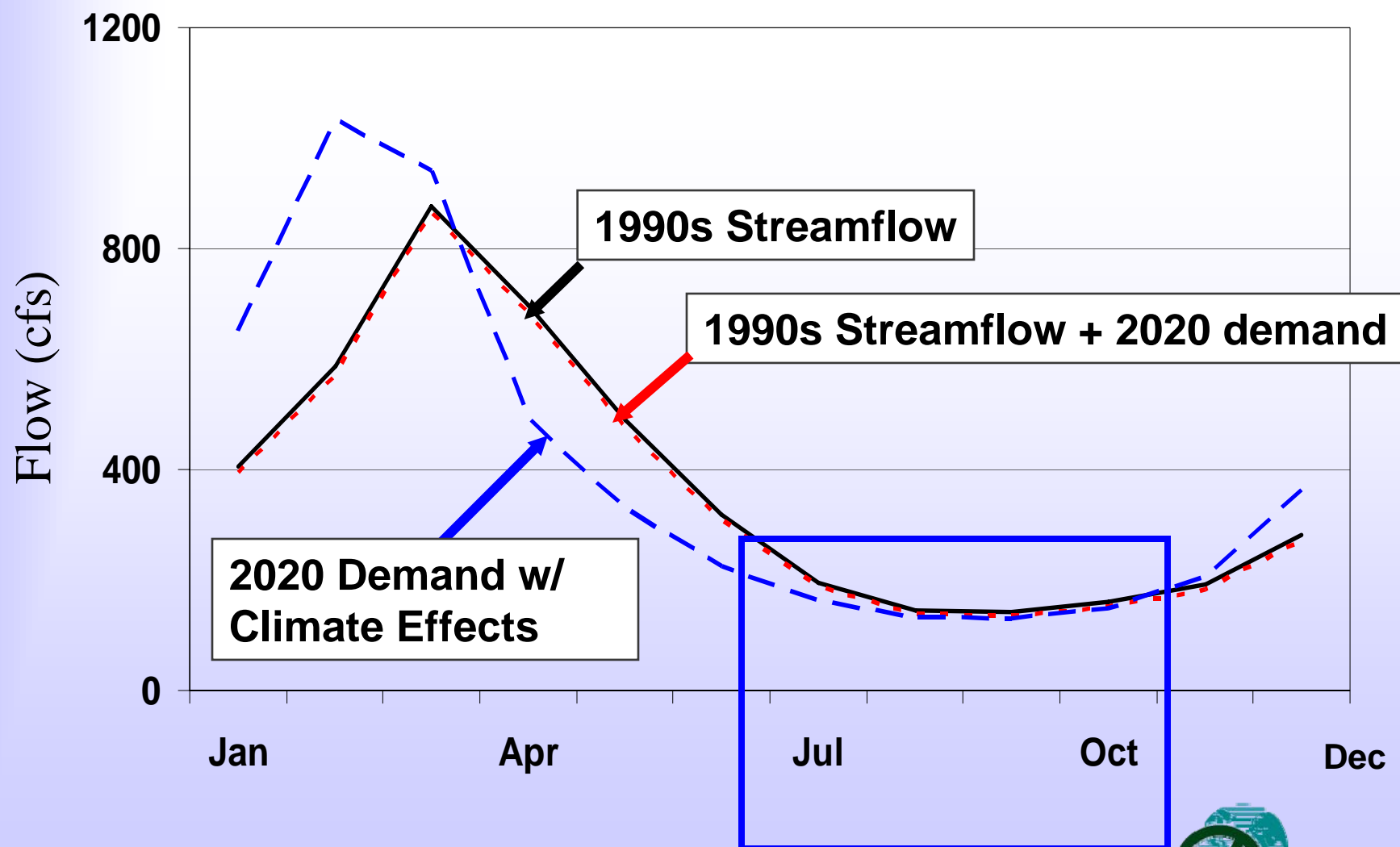
Spokane County



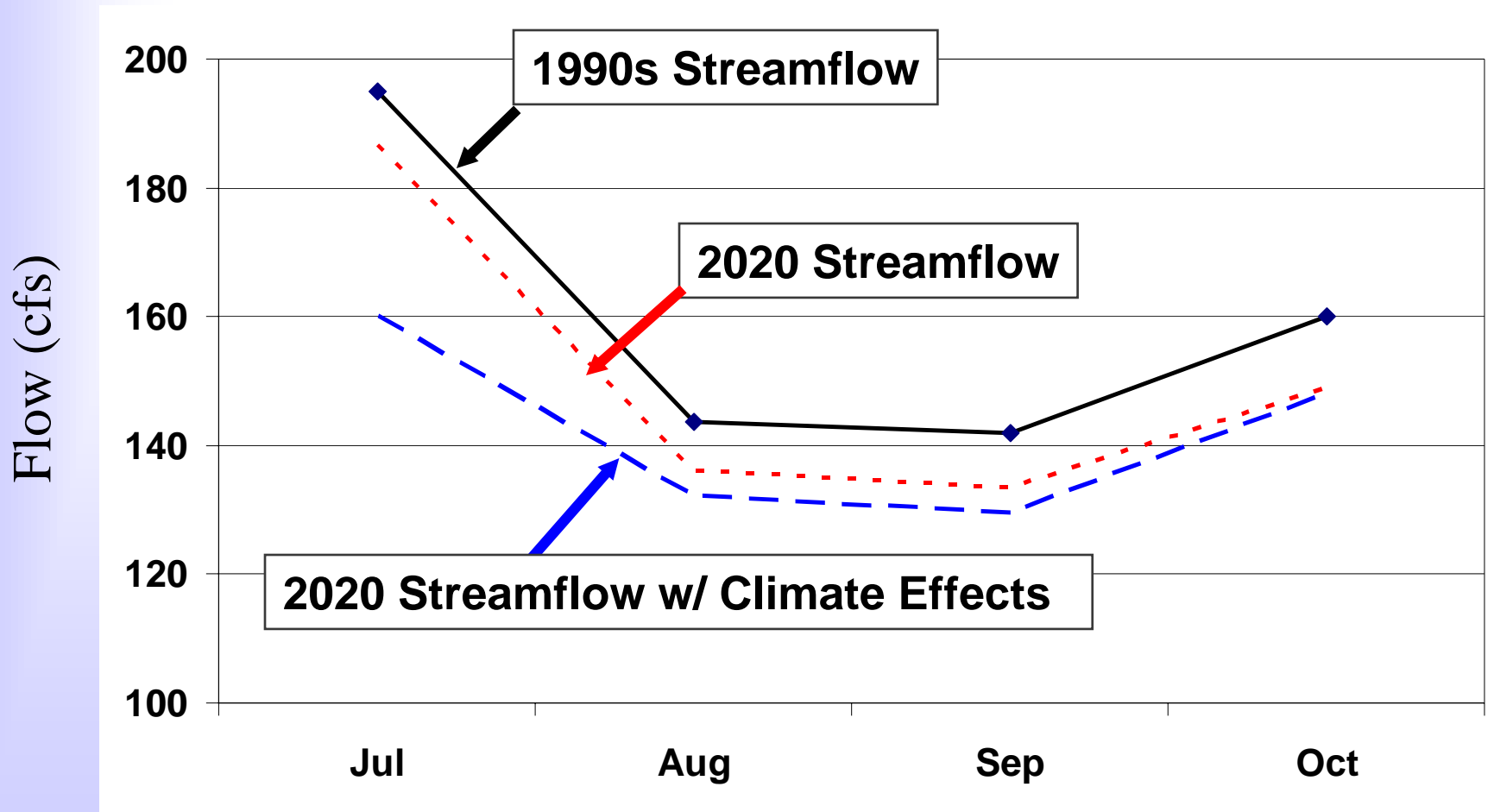
Little Spokane River Stream Flows



Little Spokane River Stream Flows



Little Spokane River Stream Flows



How will Global Warming Affect Groundwater Supply?

FACTS:

- ◆ More water in the winter
(more storm water runoff)
- ◆ Less water in the summer
(evapotranspiration > rain)
- ◆ Less recharge to groundwater

How will Global Warming Affect Groundwater Supply?

Practical concerns

- ◆ Groundwater levels ↓
- ◆ Some wells will go dry
- ◆ Well retrofits (lowering pumps, deepening wells)
- ◆ Pumping costs ↑



How will Global Warming Affect Groundwater Supply?



Policy Concerns

- ◆ Conflict for water
 - baseflows to streams
 - senior water rights, new water rights?
- ◆ Interpretations
 - Over development?
 - Land use?
 - Climatic effects?

Solutions

- Stormwater management
- Aquifer Storage & Recovery
- Reclaimed water
- Conservation

